Just as a river has a depth which is a function of the volume of water flowing, it is evident that a stream of gases will have a thickness which is a function of the volume of gases flowing. If, on this basis, water is used to simulate the cold air and colored kerosene to simulate the hot gases flowing in the flue, it would not be difficult to show a smoke flue filled or partially filled with a stream of kerosene. This demonstration is considered useless as it has been thoroughly established that flowing streams of hot gases do not require anything to confine their lower surface and that the thickness or depth of the stream is a function of the volume of the gases which are flowing.

Therefore, when currents of hot gases are dealt with, they will always be represented as *inverted streams of water.*

IV. APPLICATION OF THE LAWS OF HYDROSTATICS TO HOT GASES.

The weight per cubic meter of the products of combustion of the ordinary combustibles varies from 1 kg 29 to 1 kg 33 at 0° and 760 mm. The computations may be simplified, and will be sufficiently exact, if the first of these values is assumed as the weight of the products of combustion, because this value is also the weight of a cubic meter of air. At any temperature t the weight of 1 cu m of the hot gases will be, therefore, $\frac{1.29}{1+at}$ kg, in which $a = \frac{1}{273} = 0.00367$.

By reason of this large coefficient of expansion of gases, the difference between the weight of a cubic meter of atmospheric air (1 kg 29) and a cubic meter of the gases of combustion, taking, for example, those in an open-hearth furnace (0 kg 17) is quite large, being equal to 1.29—0.17 = 1 kg 12. It is this difference between the weight of the air and the weight of the flame or hot gases which causes the hydrostatic pressure of the

latter.

The following experiments will serve to make this clear (Fig. 9). The upper surface of the water in a beaker is at aa; and *B* is a lamp chimney into which kerosene has been poured until its lower surface is at the bottom of the lamp chimney. It can be seen that the upper surface of the kerosene 66 in the lamp chimney is higher than the surface of the water in the beaker.

The difference in level between *aa* and 66 can be computed in